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(56) Related Art
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Retention Crank Assembly

ABSTRACT

A retention system (10) retains a mating assembly of a tooth and an adapted for an earth moving bucket. The system (10) includes a pair of cams that can be rotated between first positions (11) and second positions (12). The cams are affixed to each end of a transversely extending shaft (13) having an octagonal cross-section. A keyhole (14) is formed in an exposed face of one or both of the cams and receives a suitable tool to effect rotation of the shaft (13) and cams. The shaft (13) passes through a resilient material (17) having a hole (18) having a shape corresponding with the external shape of the shaft (13). Upon rotation of the shaft, it passes through points of maximum resistance as edges (23) of the shaft (13) pass the centre of flats (24) of the hole (18).

AUSTRALIA

Patents Act 1990

COMPLETE SPECIFICATION

STANDARD PATENT

Retention Crank Assembly

The following statement is a full description of this invention, including the best method of performing it known to me:

FIELD OF THE INVENTION

The following invention relates to retention assemblies, typically for attaching replaceable implements to earth working buckets of excavating equipment and the like. The invention also relates to a method of attachment, and to earth working buckets with replaceable implements attached by means of the connection assemblies. The invention also has application to the attachment of one component to another where tight, inter-engagement is desirable and in situations where replaceable wearing parts must be retained firmly against other components in abrasive and high vibration environments.

In the particular field of earth working buckets used for heavy earth working applications such a mining, the buckets are fitted with teeth for engaging the ground surface. Due to the highly abrasive nature of the materials encountered by the teeth, they wear more quickly than the bucket. For this reason, they are detachably connected to the bucket to allow replacement.

On smaller buckets, the teeth are generally attached to an adaptor on the bucket by means of a connection pin. On larger buckets, intermediate adaptors are attached to the bucket nose and the teeth are attached to respective of the intermediate adaptors. Both connections are by means of connection pins, so that the teeth and intermediate adaptors can be replaced as required.

Connection pin assemblies of the type generally employed are known in the art as clamp and wedge assemblies, spool and wedge assemblies or pin and lock assemblies.

Prior art clamp and wedge assemblies include a clamp, often C-shaped with tapered engagement surfaces which can be inserted into aligned apertures in the parts to be connected. A wedge is then inserted to contact the rear surface of the C and is driven home by sledge hammer to cause lateral expansion of the clamp and wedge until it bears firmly against appropriate parts of the inner walls of the apertures to provide lateral loading and optionally a clamping action of the adaptor in the case of "Whistler" style attachments. Any part of the clamp and wedge protruding above or below the aligned apertures is then cut off by oxy acetylene equipment.

The tightness of the connections must be regularly monitored, and when a tooth or intermediate adaptor works loose, the clamp and wedge must be tightened by hammering the wedge in further. This can be difficult as the protruding part of the wedge may already have been removed and thus the end of the wedge is not readily accessible. When the tooth or intermediate adaptor requires replacement, the clamp and wedge often has to be cut out.

It will be appreciated that the fitting, monitoring, adjustment and removal of the prior art clamp and wedge assemblies is time consuming and labour intensive, particularly as each bucket will have a number of teeth and an equal number of adaptors, each attached by respective clamp and wedge assemblies.

International patent application No. PCT/AU94/00035 describes a clamp and wedge assembly in which a pair of clamps are forced apart by a pair of wedges which are drawn together by a bolt. While that disclosure is in some respects an improvement over the prior art, it leaves scope for improvement. For example, the arrangement is relatively complicated, still requires regular monitoring and adjustment and, in practice, may need to be cut out for removal.

The arrangement in Australian patent application No. 65583/96 overcomes at least some of the above disadvantages by providing a clamp and wedge drawn together by a bolt, and disengagement means engaging with the wedge to bear against the bolt, forcing separation of the clamp and wedge.

U.S. patent No. 5,964,547 discloses a clamp (spool) and a wedge having respective ramping surfaces which convert relative axial movement into lateral expansion of the assembly. A screw member is located in a recess in the spool's ramping surface, a thread segment of the screw member engaging formations on the wedge to drive the axial movement. This is a distinct improvement over the prior art thereto but might still require re-tightening in the field and also leaves a portion of the wedge projecting above the aligned apertures.

OBJECT OF THE INVENTION

It is the object of the present invention to overcome or substantially ameliorate at least one of the above disadvantages and/or more generally to provide an improved retention system.

DISCLOSURE OF THE INVENTION

There is disclosed herein a retention system for securing an outer component to an inner component, the outer component having a pair of opposed apertures and the inner component having a transverse aperture, the transverse aperture in use being positioned in between and in general alignment with the opposed apertures, the retention system comprising:

a resilient material located within the transverse aperture and having a transverse hole therethrough,

a shaft extending through the transverse hole in the resilient material and having an eccentrically projecting cam fixed to or integrally formed at each end thereof, each cam bearing upon the outer component upon pivotal reorientation of the shaft and cams whereupon the resilient material elastically deforms and provides a

retaining force between the inner and outer components via the cams, shaft and resilient material.

Preferably the shaft is polygonal in cross-section.

Typically the shaft is octagonal in cross-section.

Alternatively, the shaft might be circular.

Preferably the transverse hole in the resilient material has an internal face or faces corresponding with the external face or faces of the shaft.

Preferably each of said cams is located within a respective one of said opposed apertures.

Preferably the cams are substantially circular.

Alternatively, the cams might include a lobe.

Preferably the lobe is aligned with a flat surface of the hole passing through the resilient material.

Preferably the shaft and the cams have a first pivotal orientation wherein the resilient material is unloaded thereby.

Preferably the reorientated position of the shaft and cams is at 180° from the unloaded orientation.

Preferably at the reorientated position of the shaft and cams, the cams are orientated between a pair of maximum loading orientations, as a result of the cams being aligned with one of the faces of the transverse hole though the resilient material.

Preferably the transverse hole through the resilient material has a wear-resistant or anti-abrasive coating or surface treatment.

Preferably the cams and shaft have means engageable with a tool to effect rotation of the cams and shaft.

Preferably the means to effect rotation is a key recess.

BRIEF DESCRIPTION OF THE DRAWINGS

A preferred form of the present invention will now be described by way of example with reference to the accompanying drawings wherein:

Figure 1 is a schematic end elevational view of a retention system for securing an outer part to an inner part and showing a cam in a first, unlocked position and a second, locked position rotated through 180°;

Figure 2 shows the retention system of Figure 1, but also depicting an area that is filled with a resilient material such as rubber;

Figure 3 is a schematic transverse cross-sectional elevational view of the system of Figures 1 and 2 assembled in a mating assembly comprising a tooth and an adaptor for an earth moving bucket;

Figure 4 shows the system of Figure 3, although with the shaft and cams rotated through 180° into a working position; and

Figure 5 is an illustration similar to Figure 4, although showing loading force vectors.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In Figure 1 of the accompanying drawings there is schematically depicted a retention system 10 which is typically installed in association with inner and outer components to be retained. These components might typically be a mating assembly of a tooth and an adaptor for an earth moving bucket. The system 10 includes a pair of cams that can be rotated between first positions 11 and second positions 12 to be described below. A

cam is affixed to or formed integrally with each end of a transversely extending shaft 13 which in the depicted embodiment is octagonal in cross-sectional shape.

Into the exposed face of one or both of the cams there is provided a keyhole 14 to receive a suitable tool to effect rotation of the shaft 13 and cams. Each cam has a lobe 21 as shown.

The shaft 13 passes through a resilient material 17 such a rubber having a hole 18 extending therethrough. The shape of the hole 18 corresponds with the external shape of the shaft 13, ie. octagonal in the depicted embodiment. The resilient material extends into a slot 15A formed within a hole 15 in an adaptor 20. That is, the hole 15 as shown in Figure 3 passes the whole way through the adaptor 20 and the resilient material 15 fits within that hole with a protrusion 17A extending into the slot 15A to prevent rotation of the resilient material within the hole 15.

The hole 18 through the resilient material may have an internal surface coating of anti-abrasive material or be provided with some other wear resistant coating or treatment.

Also shown in Figure 1 is a hole 16 formed in the outer component which might typically be the tooth to be attached to the adaptor 20. As best shown in Figures 3 to 5, a pair of these holes 16 are provided, one in each of the outer shroud parts 22 of the tooth 19.

In order to interconnect the two components 19 and 20, they are brought together so that the holes 16 and the hole 15 are substantially aligned at which point the shaft 17 having the resilient material 17 already located thereabout is inserted through the aligned apertures such that each of the cams resides within one of the holes 16. A tool can then be inserted into the keyhole 14 to effect rotation of the shaft 15 such that the cams rotate from position 11 to position 12 (Figures 3 and 4) respectively. The shaft 13 rotates within the hole 18. During rotation the shaft passes through three points of maximum resistance as the edges 23 of the shaft 13 pass the centre of the flats 24 of the hole 18. When the edges 23 are aligned with the corners 25 of the resilient

material 17, a natural rest position is achieved. At the orientation of the shaft depicted in Figure 4, the shaft is in one of these rest positions with the cams at position 12 bearing hard against the left hand inner surface of the respective holes 16. The resilient material is deformed as a result of the interaction of the cams with the holes 16 resulting in loading L as depicted in Figure 5 between the resilient material and the adaptor 20 and reaction forces R being developed at the back surfaces of the holes 16 as shown. That is, the resilient material is compressed against the front of the hole in the adaptor 20. The cams cannot without assistance rotate back to their insertion position (the Figure 3 position) as have passed through the points of maximum resistance to reach their working position and hence must pass back through these points to the insertion position of Figure 3. This, they cannot do without the assistance of a tool inserted into the keyhole 14.

The removal of the shaft, cams and resilient material is the reverse of the installation process. That is, the cams are rotated from position 12 to position 11, in which position the components can be laterally removed, allowing the tooth 19 to be removed from the adaptor 20.

The resilience of the material 17 serves to retain the tooth 19 to the adaptor 20 under heavy, vibrational work loads.

It should be appreciated that modifications and alterations obvious to those skilled in the art are not to be considered as beyond the scope of the present invention. For example, the retention system is not limited in application to the inter-connection of a tooth and an adaptor as there are other application such as in rigging equipment and other areas where retention is required between two components in a highly abrasive, vibrating or rigorous environment.

Furthermore, other means of preventing unwanted rotation of the shaft within the resilient material may be adopted. Also the shaft need not be octagonal, as other polygonal shapes, circles or other smooth profiles may be developed. For example an elliptical profile might work well.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A retention system for securing an outer component to an inner component, the outer component having a pair of opposed apertures and the inner component having a transverse aperture, the transverse aperture in use being positioned in between and in general alignment with the opposed apertures, the retention system comprising:

a resilient material located within the transverse aperture and having a transverse hole therethrough,

a shaft extending through the transverse hole in the resilient material and having an eccentrically projecting cam fixed to or integrally formed at each end thereof, each cam bearing upon the outer component upon pivotal reorientation of the shaft and cams whereupon the resilient material elastically deforms and provides a retaining force between the inner and outer components via the cams, shaft and resilient material.

2. The retention system of claim 1 wherein the shaft is polygonal in cross-section.

3. The retention system of claim 1 wherein the shaft is octagonal in cross-section.

4. The retention system of claim 1 wherein the shaft is circular.

5. The retention system of any one of claims 2 to 4 wherein the transverse hole in the resilient material has an internal face or faces corresponding with the external face or faces of the shaft.

6. The retention system of any one of the preceding claims wherein each of said cams is located within a respective one of said opposed apertures.

7. The retention system of any one of the preceding claims wherein the cams are substantially circular.

8. The retention system of any one of claims 1 to 6 wherein the cams include a lobe.

9. The retention system of claim 8 wherein the lobe is aligned with a flat surface of the hole passing through the resilient material.

10. The retention system of any one of the preceding claims wherein the shaft and the cams have a first pivotal orientation wherein the resilient material is not loaded by the shaft.

11. The retention system of any one of the preceding claims whereupon said pivotal reorientation of the shaft and cams, said shaft and cams are at 180° from the unloaded orientation.

12. The retention system of claim 5 whereupon said reorientation of the shaft and cams, the cams are orientated between a pair of maximum loading orientations, as a result of the cams being aligned with one of the faces of the transverse hole though the resilient material.

13. The retention system of any one of the preceding claims wherein the transverse hole through the resilient material has a wear-resistant or anti-abrasive coating or surface treatment.

14. The retention system of any one of the preceding claims wherein the cams and shaft have means engageable with a tool to effect rotation of the cams and shaft.

15. The retention system of claim 14 wherein the means to effect rotation is a key recess.

16. A retention system substantially as hereinbefore described with reference to the accompanying drawings.

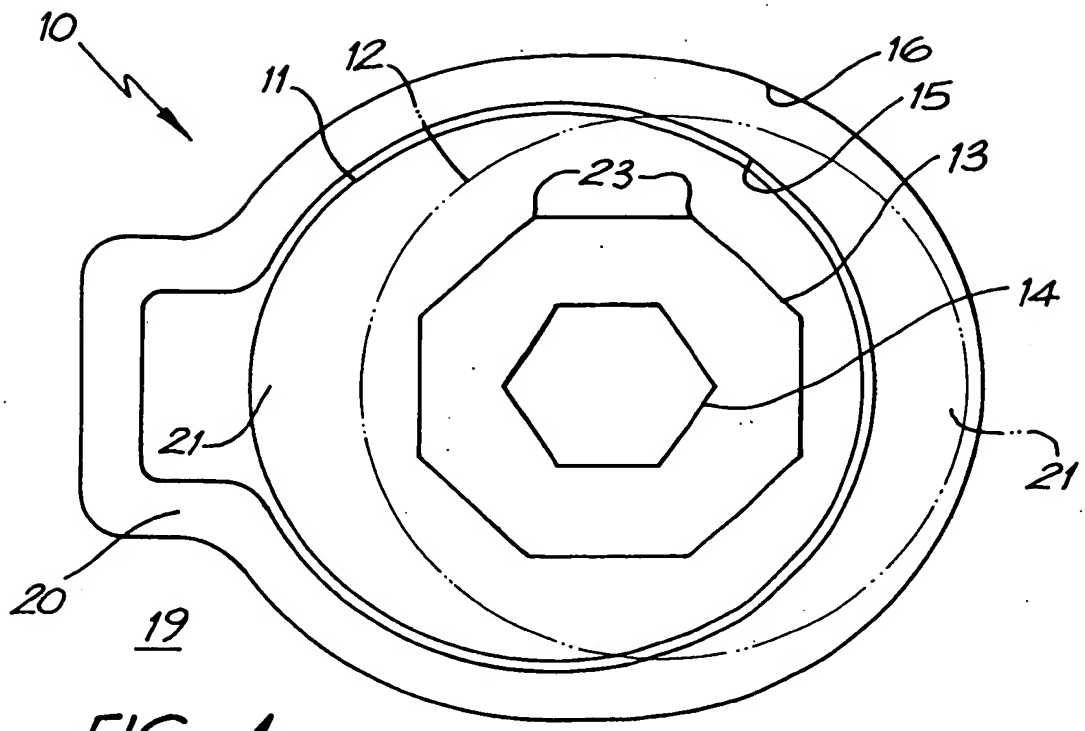
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FIG. 1

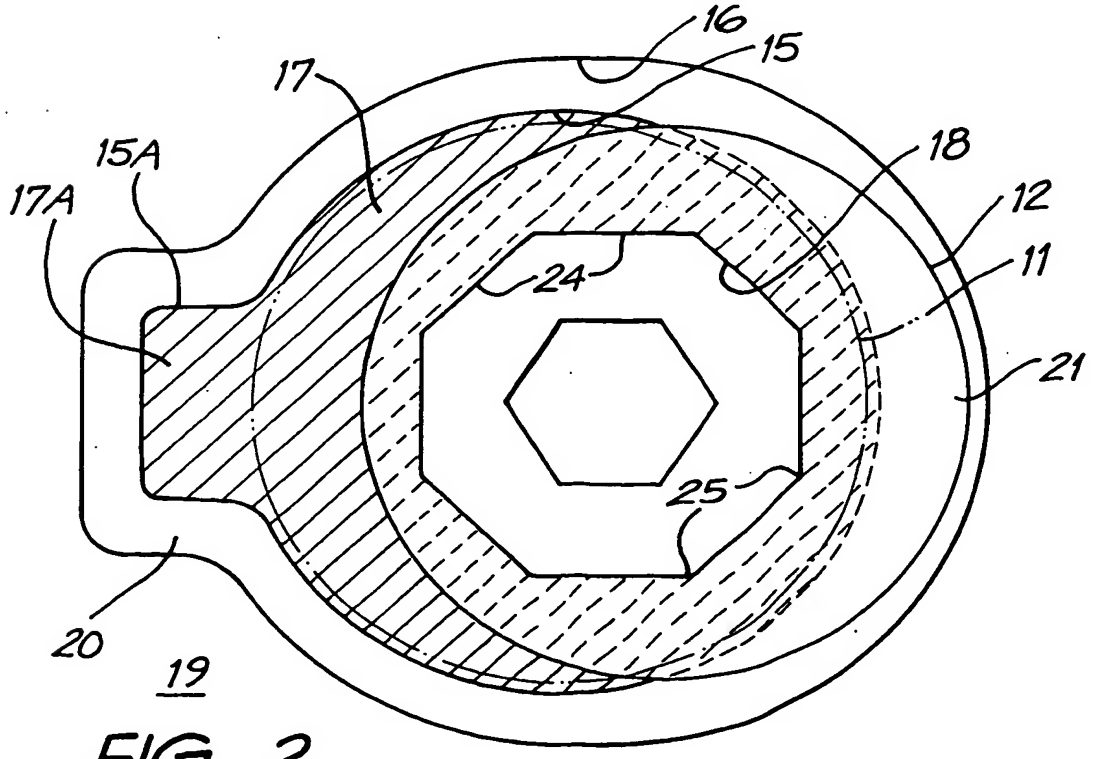
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FIG. 2

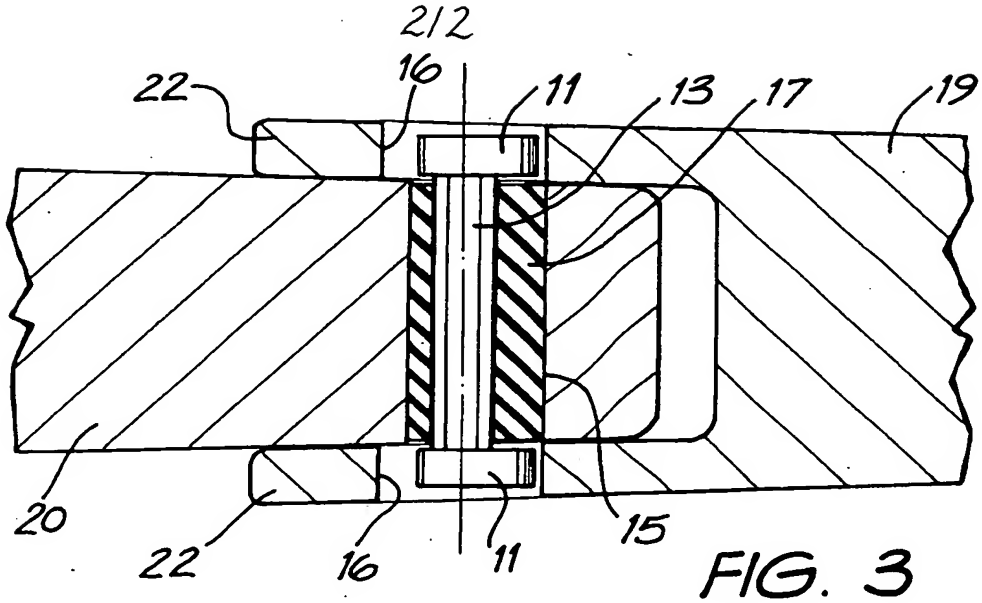

FIG. 3

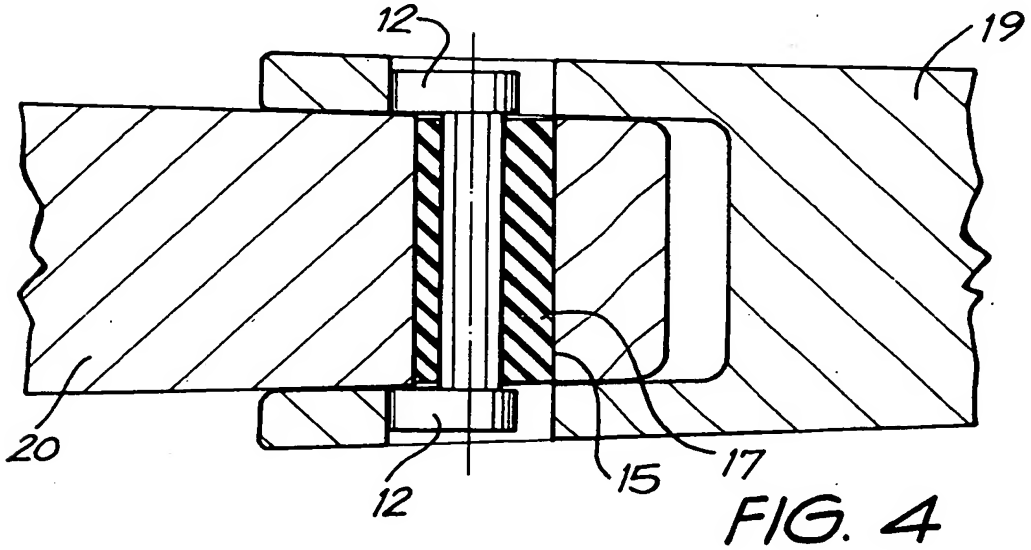

FIG. 4

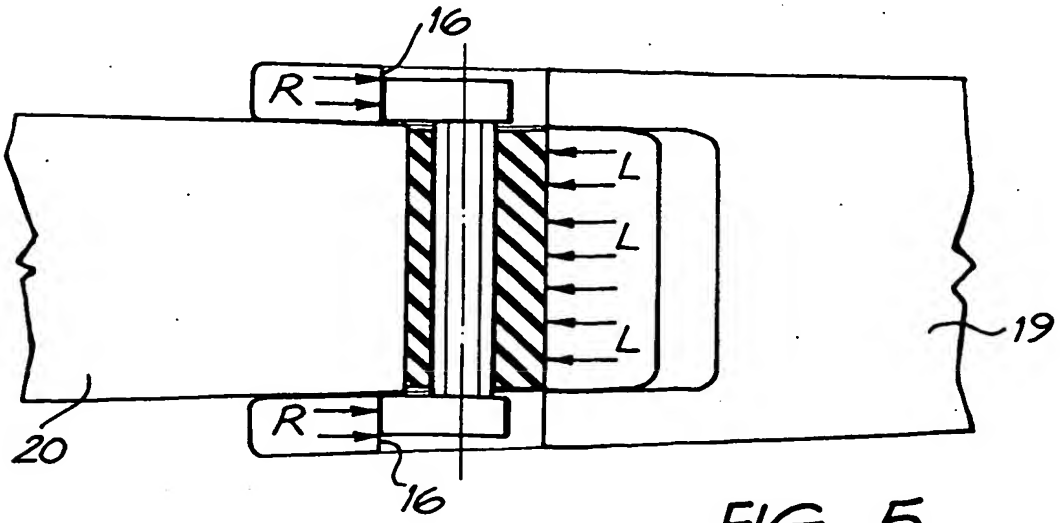

FIG. 5